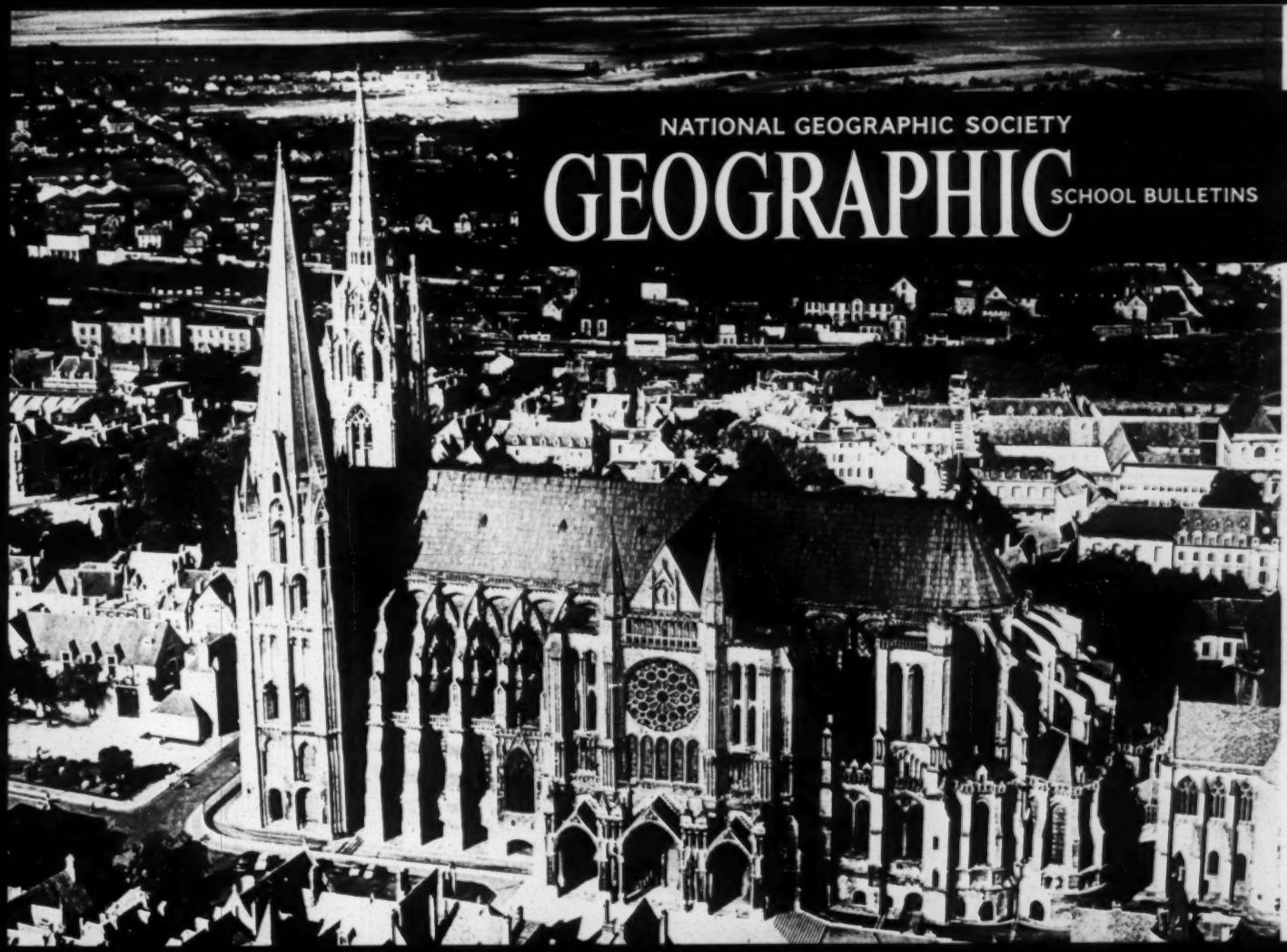

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Cover: Majestic spires of France's Chartres Cathedral affirm Christianity (p. 286)

Before the war, many were transported to America; now that safety valve was lost and the jails were packed.

So the "first fleet" set sail for Australia. Eleven ships, carrying 1,500 people, 800 of them convicts, arrived near the present city of Sydney in 1788—the year the American Constitution was ratified.

The settlers and convicts found a continent half desert, inhabited by the world's strangest animals—kangaroos, duck-billed platypuses—supporting in meager fashion some 500 tribes of aborigines.

Always in Australia the problem has been water. A rainfall map and a population map side by side look identical—the edges of the continent a lopsided doughnut of well-watered, well-peopled land surrounding the arid, empty center.

The flattest of continents, Australia has but one series of mountains, the Great Dividing Range along the eastern shore. To the east the rivers tumble through the coastal plain and into the Pacific. On the western slopes rivers have a tendency to

One-third of the world's wool comes from Australian sheep like that at right. Well over a billion pounds a year is shipped, making half the value of all exports. In addition to 139 million sheep (15 times the human population) Australia grazes some 16 million cattle (below)—enough to ship meat to Britain and other countries and still provide plenty for the national breakfast—steak and eggs. Mutton, lamb, butter, and cheese are also exported.

AUSTRALIAN NATIONAL PUBLICITY ASSOCIATION. ABOVE, HOWELL WALKER, NATIONAL GEOGRAPHIC STAFF

UMI

AUSTRALIAN NEWS AND INFORMATION BUREAU. COVER, WALTER MEAYERS EDWARDS, NATIONAL GEOGRAPHIC STAFF

THE UNITED STATES OF AUSTRALIA

THE UNITED STATES and Australia have similar—even intertwining—histories. Some of the obvious resemblances: both were founded as British colonies, but have long since won independence. Both relied on European immigrants to people their continents. Though each has a strong agricultural base, both are nations of city dwellers (above, Melbourne, capital of the state of Victoria). Both are democratic and both are federal—having a combination of state and national governments. The two were almost identical in size before Alaska and Hawaii joined the Union.

Australia has been called "a stepchild of the American Revolution." When the 13 colonies won their freedom, the island continent was almost unknown. Early voyagers had landed on the forbidding northwest coast and reported their disillusionment: "A barren, accursed earth," wrote one.

Capt. James Cook had discovered the fertile eastern shore in 1770 but it is doubtful that British settlement would have been attempted if the American colonies had remained happily in the Empire.

At the end of the Revolution some American Tories—persons who had remained loyal to the Crown instead of joining the rebels—were not too popular in the new nation. They asked Britain to resettle them in Australia.

Britain had another Revolution-based problem. Laws were harsh in 18th-century England; men, women, even children, were sentenced to long terms in prison for petty offenses.

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vanish. Flowing into dry areas, they grow smaller and smaller and finally disappear.

Where the rivers flow the land is already well-watered, where they disappear there is much fertile but parched land. To correct this mistake of nature the Australians are engaged in a billion dollar program to tunnel through the Snowy Mountains in the south, capture the Snowy River and its tributary the Eucumbene, and shunt them to the other side of the range. Already half completed, the project will have seven major dams, at least 12 smaller ones, 83 miles of major tunnels, and 330 miles of aqueducts. On its way through the mountains, the water will be wrung through turbines to produce electricity for Australia's rapidly growing industry.

Here the resemblance to the United States' Tennessee Valley Authority has brought a friendly rivalry. A hillbilly song written by a workman on the project has become popular across the country. Known as "Snowy River, Roll" it begins:

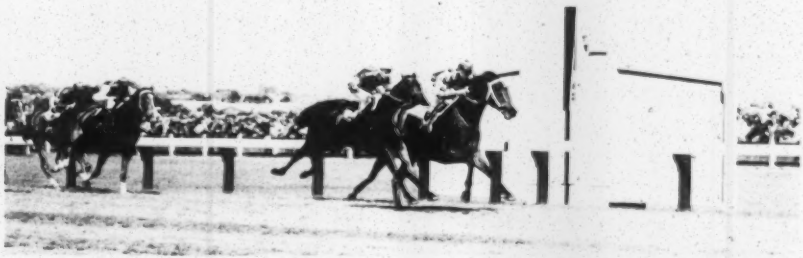
Give me a man who's a man among men,
Who'll stow his white collar and put down his pen.
We'll blow down a mountain and build us a dam,
Bigger and better than old Uncle Sam!

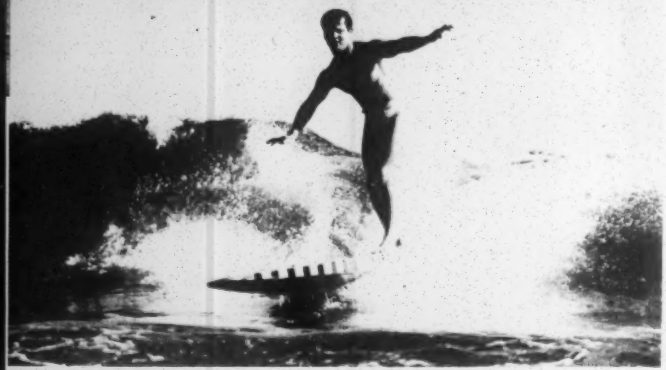
Many workers on this project are "New Australians," Europeans brought in since World War II. Australia welcomes immigrants—even pays their fare, or part of it. More than a million have come to work in booming mines, factories, and farms, making up a tenth of the entire population. A stroller in Sydney (below) can hear "Waltzing Matilda," the national folk song, sung in a dozen different accents, and "diggers" find themselves enjoying shish-kebab, sauerkraut, enchiladas, and borsch. F.S.

AUSTRALIAN NEWS AND INFORMATION BUREAU

UMI

ENJOYING THE SPORTING LIFE DOWN UNDER





AUSTRALIAN NEWS AND INFORMATION BUREAU

Australians love sports, whether as players or as watchers. Horse races are held in all states throughout the year. The Melbourne Cup, shown above, brings out crowds of style-conscious watchers, such as those at left above. Surf riding (left) probably has more supporters than any other Australian sport, since the largest cities are near the ocean and the warm climate makes almost year-round swimming possible in many places. Starting in sports at an early age, Australian children become expert. Many world's champions in running, swimming, tennis (right), and other sports have come from the relatively small Australian population. Cricket is the national sport; its "world series" is a match with a British team.

following the angle of the sun. After hulling, the beans are ready for export.

For a decade or more the government has encouraged more planting of other crops—sugar cane, cotton, henequen, rice, cacao, and tobacco. At one time, El Salvador's trees produced most of the world's Balsam of Peru, a gum used in medicines.

Infant industrial growth depends largely on the Lempa River project which doubled the country's electric power. The chief manufacturing enterprise is the production of cotton textiles. Minerals await development. Cattle and sheep graze in many sections.

But what strikes the eye of the visitor is the physical beauty of El Salvador. Above blue lakes and green fields cone-shaped volcanoes tower. Most are dead. One—Izalco—erupted four years ago. Formerly its regular eruptions—one every eight minutes or so—gave it the name, "the lighthouse of the Pacific." Sailors could see its fires and smoke far out at sea.

Serene Salvadoran offers small green peaches to sightseers on the road to San Salvador Volcano. Hibiscus and other flowering plants grow in abundance.

Its productive volcanic soil makes El Salvador the most densely populated of the Central American states, but it ranks as the smallest nation in the Americas.

Landing in one of the small Pacific ports (El Salvador has no Atlantic coast) the traveler climbs inland to mountain-ringed San Salvador, the capital. A modern city in an old country, San Salvador was almost completely rebuilt after an earthquake and eruption in 1917. It is laid out in the form of a cross at the foot of San Salvador Volcano, now a quiet park (above).

La Palma, near the Honduran border, retains the Spanish colonial look. The simple church (left) shows the low roof, thick walls, and small domes that help it withstand earthquakes. Government workers vacation in La Palma's old world atmosphere and high altitude. R.R.—R.G.

NO ISSUE Easter week. Next issue April 10, 1961.

UMI

Tiny, Coffee-rich El Salvador

PEDRO DE ALVARADO, efficient conquistador, looked for worlds of his own to conquer after helping Cortés win Mexico. Galloping south into Central America, he ran roughshod over tribe after tribe, finally subjugating the Pipil Indians in 1525 on the Eve of the Roman Catholic festival of San Salvador (Holy Saviour).

Claiming their fertile, volcano-dotted lands for God and King (and Alvarado), he built a city, San Salvador, and established a new Spanish colony, El Salvador, looking south onto the blue Pacific.

An independent nation since 1839, the Republic of El Salvador still bears the stamp of Alvarado while finding its place in the modern world.

Of every hundred Salvadorans, at least 90 are Indian or part Indian (mestizo). The other ten, of purer Spanish descent, govern the country, own most of the land, and control the economy. Nearly everybody speaks Spanish and goes to Mass.

More than one-third of the 1,850,000 Salvadorans work on plantations, or *fincas,* such as the one in the picture at the left. Coffee is the money crop, but much of the acreage supplies food for the workers. Beyond the patches of corn and beans, coffee grows on the slopes of extinct volcano San Vincente. In the foreground lies a coffee-drying patio.

Slightly smaller than New Jersey, El Salvador sells the United States enough coffee to supply every adult a pound a year. The little nation's climate and altitude account for the unusually large yield.

El Salvador rises from a tropical lowland along the Pacific to a mountain range studded with volcanic peaks. A high valley hangs between this range and one farther inland—all paralleling the coast. Coffee thrives in this valley.

The trees are kept pruned to a height of 10 or 12 feet, to facilitate hand picking of the beans. Hot rays of the sun are blocked from the plants by a shade tree—the pepeto. It closes its leaves at night to allow moisture to reach the coffee trees beneath it, opens them during the day to prevent night dew from evaporating.

A fragrant white bloom appears, giving way to a berry which grows in clusters along the branches. When red, the berries are picked, taken to the drying patio, and spread in the sun. Now known as beans, they are continually turned and raked in furrows,

Photographs by Rosamond Rohlfs

Feast of Space

carbon dioxide as a waste—or in association with sewage. Bacteria feeding on sewage release carbon dioxide. Chlorella can supply oxygen to the bacteria, and in turn absorb the carbon dioxide. This method is being studied at the University of California and may lead to the first commercial use of Chlorella.

The future of Chlorella will likely depend on basic research being done at universities and other institutions all over the world. University of Maryland botanists, for example, are conducting a wide range of experiments to answer such questions as: What is the best light intensity for growing algae? What is the effect of antibiotics on bacteria attacking algae? Can algae be improved by changing their genes—carriers of heredity—with X-rays?

For half a century Chlorella has been used for experiments in photosynthesis, the process by which a plant, using light for energy, manufactures food (see *Geographic School Bulletins*, March 13, 1961). Under laboratory conditions, Chlorella is remarkably efficient. A scientist has estimated that Chlorella growing on an area only twice the size of Rhode Island would be enough to meet the protein needs of the entire world.

Some scientists question these rosy forecasts. They point out that comparisons are made between Chlorella grown under the most pampered laboratory conditions and other plants grown with ordinary agricultural techniques. But researchers are convinced that what they are now learning about Chlorella may go a long way toward meeting the food and fuel needs of the world's soaring population. E.C.

BOEING AIRPLANE COMPANY

From lab to kitchen—The scientists above at the Boeing Airplane Company, Seattle, selected a child's wading pool as the right size and shape for growing experimental algae.

Piped gas bubbles through the tiny farm. To test results of a taste-improving technique, Dr. Arthur Pilgrim at left samples cupcakes baked by his 15-year-old daughter, Vicki. She substituted powdered algae for 20 per cent of the flour in her favorite recipe. "A pleasant taste," Dr. Pilgrim declared.

UMI

STANDARD OIL COMPANY OF NEW JERSEY

Scum of the Earth May Become

SCIENTISTS are studying a microscopic green plant as a possible food for men journeying to the moon or Mars.

This one-celled plant, known as Chlorella, might be harvested from miniature "farms" inside rocket ships hurtling through space. The plant would absorb carbon dioxide exhaled by passengers, and give off oxygen. Thus it would purify the air as well as supply food.

Chlorella is a member of the algae plant group that forms green scum on ponds, such as the one in Saudi Arabia, left. Laboratories grow it in vessels of water containing nitrogen, phosphorus, potassium, and other chemicals (far right). Air charged with carbon dioxide is fed into the vessels, and the plants are kept well exposed to light. In several days the Chlorella is ready to harvest.

The resulting food, a green paste, tastes something like raw spinach. It is one of the richest foods known to man. Grown in the proper solution, a few ounces of Chlorella could supply almost all of a man's daily vitamin needs. Depending on the solution in which it grows, the Chlorella may be more than 50 per cent protein or more than 70 per cent fat.

Experimenters try to improve algae's looks and taste. In one process the green scum is blanched under fluorescent lights to form a white powder. Cookies made from the original plant looked and tasted like "baked hay." Cookies incorporating the whitened algae tasted like cookies. This step may be important for space travelers, who will have plenty of problems without adding unpalatable meals.

Billions upon billions of Chlorella plants are needed to fill a quart jar, but the algae multiply at an amazing rate under proper conditions. Dr. Robert W. Kraus of the University of Maryland reports some algae can double in numbers 12 times every day.

Oil-rich Chlorella might be used in soapmaking and other industries. The plant can even be used to make gasoline or kerosene, because fermenting Chlorella releases methane gas, which can be converted into such liquid fuels. At present, however, these processes are too expensive for industry.

Curiously, the expense of providing carbon dioxide—one of the most common gases—is a big obstacle to commercial use of Chlorella. One solution might be to grow Chlorella in factories having

ter's wife. Others accept Him as human, the son of Mary and Joseph of Nazareth (in present-day Israel). He was born in Bethlehem (in present-day Jordan) where His parents had journeyed to be counted in a census. The Holy Land was then ruled by Rome.

The birth in this humble family revolutionized the calendar of the Western World. Men reckon time from His birth date. However, the scholar who introduced the designations B.C. (Before Christ) and A.D. (Anno Domini—in the year of our Lord) miscalculated the date of the event. Christ was born about 6 B.C.

Jesus inherited Joseph's trade and religion—Judaism. The Jewish nation had long awaited a Messiah who would found a Kingdom of God on Earth.

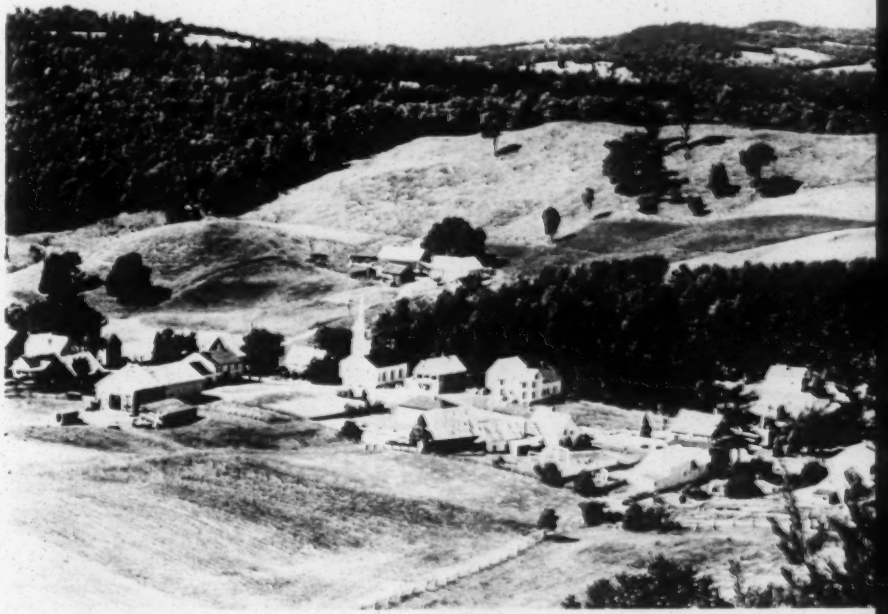
At about age 30, Jesus began His ministry. He preached the fatherhood of God and the brotherhood of man. He and His 12 disciples, trained by Jesus to help spread His message, taught mercy and justice toward all men—rich and poor, saint and sinner.

He preached only about three years. The Jewish church of the day denied that Jesus was the promised Messiah (Orthodox Jews still await the Messiah). Roman authorities regarded as treason the claim that He was King of the Jews.

He was taken into Roman custody, tried, and condemned. On Calvary, a hill outside Jerusalem, He was nailed to a cross—a customary execution method at the time. Christians commemorate the Crucifixion on Good Friday. Three days later, the Bible says, He rose from His tomb and ascended into heaven.

The cross became the symbol of Christianity. The Crucifixion and Resurrection became pledges that by the death of God's son man is redeemed and granted eternal life. "For as by one man's disobedience [Adam] many were made sinners, so by the obedience of one shall many be made righteous." (Romans 5:19)

After Jesus' death, His disciples continued to spread His message. The first believers were Jewish, but gradually began to think of themselves as members of a new faith. As followers of Christ—



NATIONAL GEOGRAPHIC PHOTOGRAPHER B. ANTHONY STEWART

UMI

DAVID S. BOYER, NATIONAL GEOGRAPHIC STAFF

Great Religions of the World, No. 5

CHRISTIANITY

THIS SUNDAY, April 2, the Christian world celebrates Easter, commemorating the Resurrection of Christ after His Crucifixion. Easter promises rebirth and redemption, basic doctrines of Christianity. More than 850,000,000 adherents make it the world's largest religion.

Pilgrims enter Jerusalem (left) on Palm Sunday and migrant potato pickers sing hymns in the fields of Long Island. An Argentine offers a prayer passing the majestic "Christ of the Andes" (below). An evangelist exhorts crowds in Kelvin Hall, Glasgow. An Indian of the Amazon jungles reads Scriptures in his own tongue, and a Roman Catholic cardinal lives as a refugee in the United States legation in Budapest. Women pray ankle-deep in a rice paddy as church bells chime in a village of India, and New Englanders go to meeting on Sunday mornings in white-spired churches like the one at right in East Corinth, Vermont.

All are Christian. What unites this diverse group? In broad terms they all believe that the way to live is to accept Jesus Christ and to follow His selfless example and teachings: to "love the Lord thy God with all thy heart, and with all thy soul, and with all thy mind;" to "love thy neighbor as thyself."

Like Islam, Christianity grew out of Judaism. Its book of faith—of which there are many versions—is the Bible. It is a combination of the Old Testament—the history of the Jews under the laws given by God to Moses—and the New Testament—describing Christ and His teachings.

Some Christian sects believe that Jesus was the Son of God, born to a poor carpen-

INTERNATIONAL TELEPHONE AND TELEGRAPH COMPANY

GILBERT M. GROSVENOR, NATIONAL GEOGRAPHIC STAFF

a Greek word meaning Messiah—they became known as Christians.

Christian belief in a single God ran counter to Roman worship of many gods. For the first three centuries after Christ's death Christians were persecuted, but in the early 4th century, the Roman emperor Constantine gave them religious freedom. A later emperor, Theodosius I, made Christianity the official religion of the Roman Empire about 380.

WASHINGTON CATHEDRAL

Conflict did not cease, however. Christians quarreled over theological questions, excommunicated and denounced each other. The bishops of Rome and the patriarchs of Constantinople (now İstanbul) competed for power. In 1054 they split into two churches: Roman Catholic and Eastern Orthodox. The Roman Catholic, with its center in Rome, is headed by the Pope. The Eastern Orthodox is only loosely united. At left the abbot of a monastery on Mount Athos, Greece, blesses his brothers.

The Renaissance spawned the Protestant Reformation. Men protested against some aspects of the Roman Catholic Church. Groups broke off to found new Christian sects. Today 255 Protestant sects are recognized in the United States alone. Above a canon of the Washington (D.C.) Cathedral (Episcopal) baptizes a child.

If the Renaissance divided the church, it enlarged Christianity. The new learning goaded men to explore new parts of the world, and the discovery of America and Australia added three continents to the Christian world.

The sign of the cross rises above churches around the world, and forms the floor plan of nearly all of them. The medieval Chartres Cathedral, in France, shows this shape in the aerial view on the cover. Its architecture symbolizes man's aspiration toward heaven. L.B.

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